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SAMSUNG DISPLAY

RoHS COMPLIANT

Product Specification

( ) **Product Information**
(√) **Preliminary Specification**
( ) **Approval Specification**

The Information Described in this Specification is Preliminary and can be changed without prior notice.

CUSTOMER	G/A Customers
DATE OF ISSUE	02/21/2013

MODEL NO.	LTI820HA01
EXTENSION CODE	-0

Customer Approval & Feedback

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REVISION HISTORY

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02/21/2013	P00	all	First issued

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GENERAL DESCRIPTION

DESCRIPTION

This model uses a liquid crystal display (LCD) that uses amorphous silicon TFT(Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit, and ass'y KIT of source PBA and BLU(Back light Unit) Ass'y. This 82.0" model has a resolution of 1920 x 1080 pixels (16:9) can display up to 16.7 Million colors with the wide viewing angle of 89° or higher in all directions.

FEATURES

High contrast ratio & aperture ratio with the wide color gamut
PVA(Patterned Vertical Align) mode
Wide viewing angle (±178°)
High speed response
FHD(1920X1080) resolution (16:9)
Edge LED(Light Emitted Diode) BLU
RoHS compliance (Pb-free)
Low power consumption
DE(Data Enable) mode
2 Channel LVDS (Low Voltage Differential Signaling) interface
The interface (2pixel/clock) of LVDS serial interface
Landscape Only
High Tni Liquid Crystal (85℃)

APPLICATIONS

Digital Information Display (DID)
High Definition Public Monitor

GENERAL INFORMATION

Items	Specification	Unit	Note
Active Display area	1805.76(H) X 1015.74(V)	㎜	
Switching Components	a-Si TFT active matrix		
Module Size	1856.0(H) x 1082.0(V)	㎜	Typ
	16.0(D)	㎜	Min
Weight	43,000	g	Typ
Display colors	16.7M (8bits-True)	Color	
Number of pixels	1,920 x 1,080	Pixel	16:9
Pixel Arrangement	RGB Vertical stripe		
Display Mode	Normally Black		
Surface Treatment	Haze 2.3% / 2H		Anti-Glare
Luminance of White	450(Typ)	cd/㎡	

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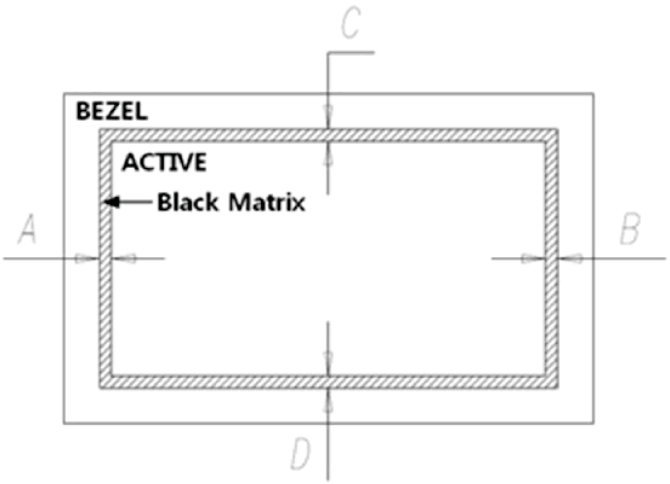
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MECHANICAL INFORMATION

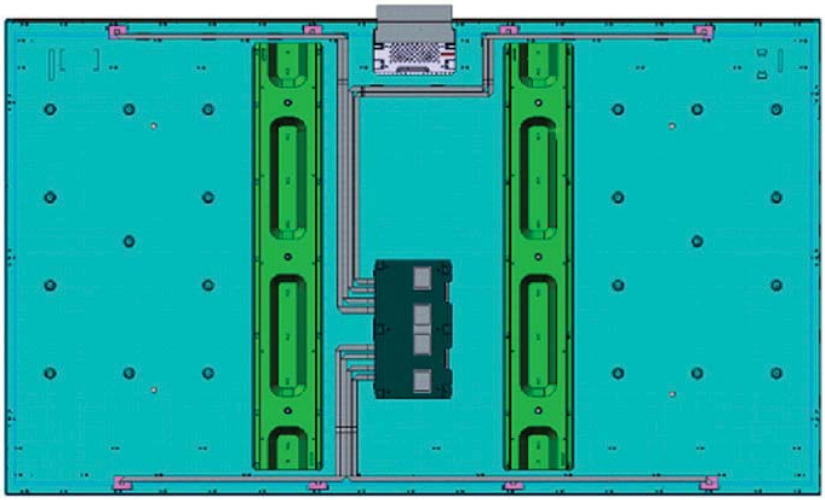
Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	TBD	1856.0	TBD	mm	
	Vertical (V)	TBD	1082.0	TBD	mm	
	Depth (D)	TBD	16.0	TBD	mm	Minimum Depth (2)
Bezel Open	Horizontal (H)	-	1816.0	-	mm	
	Vertical (V)	-	1026.0	-	mm	
Black Matrix Shift	Horizontal (H)	-	-	2.0	mm	(1)
	Vertical (V)	-	-	2.0	mm	
Weight		-	43,000	45,000	g	

Note (1) Measure the figure for **Black Matrix shift** to be recorded on the spec. with referring to the drawings.

- | A - B | ≤ Horizontal Spec
- | C - D | ≤ Vertical Spec



Note (2) Measure point of Depth (Cyan Area)



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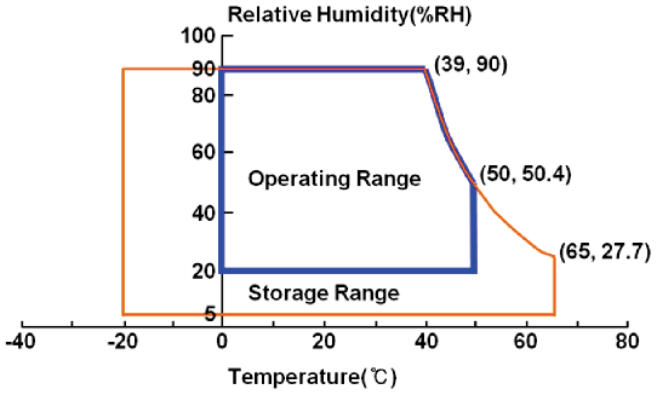
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1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE RATINGS

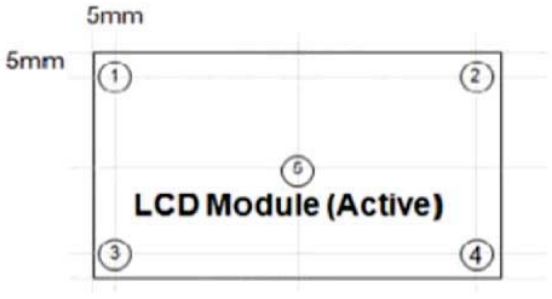
Item		Symbol	Min.	Max.	Unit	Note
Storage temperature		T_{STG}	-20	65	°C	(1)
Operation Temperature		T_{OPR}	0	50	°C	(1)
Humidity of storage		H_{SUR}	5	90	%RH	
Glass surface Temperature (Operation)	Center	T_{CENTER}	0	50	°C	(3)
	T Uniformity	ΔT	-	10	°C	
Shock (non-operating)		Snop(X,Y)	-	-	G	(2)
		Snop(Z)	-	-		
Vibration (non-operating)		V_{nop}	-	-	G	(2)

Note (1) Temperature and relative humidity range are shown in the figure below.
a. 90 % RH Max. (Ta ≤ 39 °C)
b. Relative Humidity is 90% or less. (Ta > 39 °C)
c. No condensation



Note (2) Module vibration and shock tests are not guaranteed due to limitation of equipment for this model

Note (3) Definition of Test point



△T should be less than 10℃ ($\triangle T = |T_{CENTER} - T_{CORNER}|$)

T_{CENTER} : Temperature of the center of the glass surface (Test point 5)
T_{CORNER} : Temperature of each edge of the glass surface (Test point 1~4)

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1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	10.8	-	13.2	V	(1),(2)
Dimming Control	Vdim	-	-	5.25	V	

Note (1) Within Ta (25 ± 2 °C)

(2) The permanent damage or defect to the device may occur if the panel is operated at the figure set, which exceeds a limit of maximum value stated in the former spec. The functional operation should be limited to the conditions described above under normal operating conditions.

(2) BACKLIGHT UNIT

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Input Supply Voltage / Converter	Vcc	22	-	26	V	

1.3 The Others Absolute Ratings

STATIC ELECTRICITY PRESSURE RSISTANCE

Item	Symbol	Min.
CONTACT DISCHARGE	150pF, 330Ω, ± 10kV, 210points, 1 time/point	Operating
AIR DISCHARGE	150pF, 330Ω, ± 20kV, 210points, 1 time/point	Operating

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2. APPLICATION INFORMATION FOR DID (Digital Information Display)

A DID's screen may display the sudden image such as an image retention.
To extend the lifetime and optimize a function of module, the below-mentioned operating conditions are required.

2.1 Normal operating condition

a. Temperature: 20 ±15℃
b. Humidity: 55 ±20 %
c. Display pattern: Moving image or image, which switches regularly.
Note) The sudden image on the screen can be displayed after the static image is shown in the long-term.

2.2 The operating conditions when the module is operated under the abnormal condition.

a. Ambient condition
-It is recommended to set the DID up in the well-ventilated place.
b. The function of power off and screen saver
-The function of periodical power-off or a screen saver is needed when the static image is displayed in the long-term.

2.3 Operating conditions to prevent the sudden display resulted from displaying the static image in the long-term.

a. The proper operating time: Under 12 hours a day.
b. The moving image shall be inserted between the static displays periodically.
-The refresh time for liquid crystal is needed.
c. The periodic changing of background color and character's color(image)
-Use the different color for background and character (image) respectively.
-Change colors periodically.
d. Avoid combining the color for background with the color for character, which has a largely different luminance.
Note (1) Abnormal condition means all operating condition except normal operating condition.
Note (2) The moving image or black pattern is strongly recommended as a screen saver.

2.4 Only the lifetime of DID stated in this spec is guaranteed if the DID is used under the proper operating conditions.

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3. OPTICAL CHARACTERISTICS

The optical characteristics should be measured in a dark room or the space surrounded by the similar ambient setting.
Measuring equipment : TOPCON RD-80S, SR-3, ELDIM EZ-Contrast Ta(25± 2 °C)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		C/R	-	TBD	(4,000)	TBD	-	(1) SR-3
Response time	G-to-G (AVG)	T_g	-	-	8	16	msec	(3) RD-80S
Luminance of White (At the center of screen)		Y_L	-	400	450	-	cd/m^2	(4) SR-3
Color Chromaticity (CIE 1931)	Red	R_X	Normal $\phi = 0$ $\theta = 0$ Viewing Angle	TYP. -0.03	(0.640)	TYP +0.03	-	(5), (6) SR-3
		R_Y			(0.330)			
	Green	G_X			(0.300)			
		G_Y			(0.605)			
	Blue	B_X			(0.150)			
		B_Y			(0.060)			
	White	W_X			0.280			
		W_Y			0.290			
Color Gamut		-	-	67	70	-	%	(5) SR-3
Color temperature		-	-	-	10,000	-	K	
Viewing Angle	Hor.	θ_L	CR ≥ 10	79	89	-	Degree	(6) SR-3 EZ-Contrast
		θ_R		79	89	-		
	Ver.	θ_U		79	89	-		
		θ_D		79	89	-		
Brightness Uniformity (9 Point)		B_{uni}	-	-	-	25.0	%	(2) SR-3

* Ta = 25 ± 2 °C, VDD = 3.3V, fv=60Hz, fDCLK = 148.5MHz, IF =100% duty
* If =TBD mA (each String 130 mA), VF=TBD (TBD LED String)

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Notice (a) Setup for test equipment

The measurement should be executed in a stable, windless and dark room between 40min and 60min after lighting the backlight at the given temperature for stabilization of the backlight. This should be measured in the center of screen.

The environment condition : Ta = 25 ± 2 °C

Note (1) Definition of contrast ratio (C/R)

: The Ratio of max. gray (Gmax) & min. gray (Gmin) at the center point ⑤ of the panel.

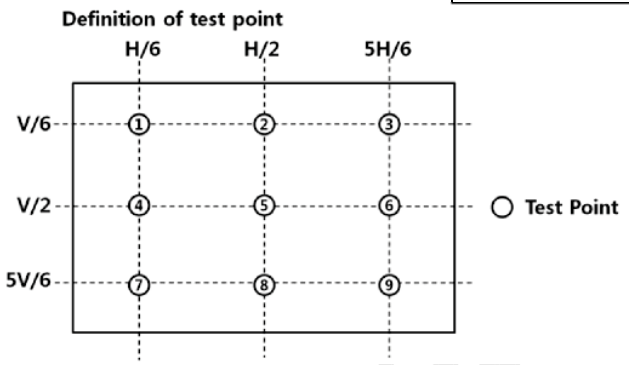
$$C/R = \frac{G\,\max}{G\,\min}$$

Gmax : Luminance in all white pixels
Gmin : Luminance in all black pixels.

Note (4) Definition of brightness uniformity at 9 points (Test pattern : Full white)

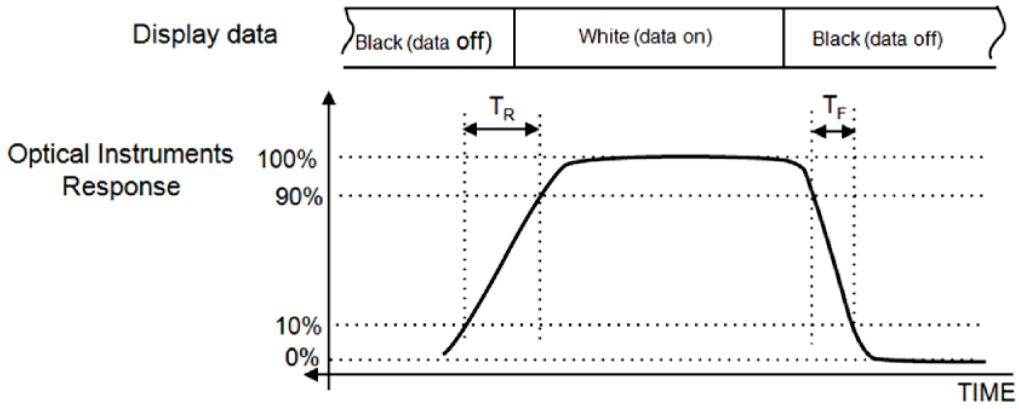
$$Buni = 100 * \frac{(B\,\max - B\,\min)}{B\,\max}$$

Bmax : Maximum brightness
Bmin : Minimum brightness



H : Horizontal Length of Active Area
V : Vertical height of Active Area

Note (3) Definition of Response time : Sume of Tr, Tf



※ G-to-G : Average response time between the whole gray scale to the whole gray scale.

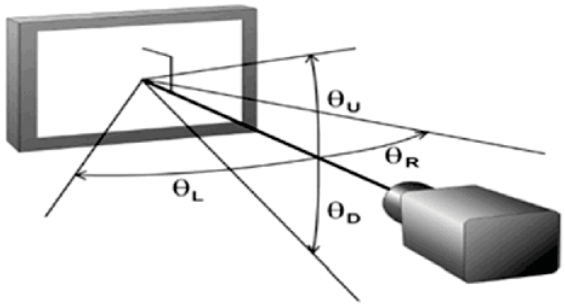
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Note (4) Definition of Luminance of White : Luminance of white at center point ⑤

Note (5) Definition of Color Chromaticity (CIE 1931)

Color coordinate of Red, Green, Blue & White at center point ⑤



Note (6) Definition of Viewing Angle : Viewing angle range (C/R ≥ 10)

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4. ELECTRICAL CHARACTERISTICS

4.1 TFT LCD MODULE

The connector to transmit a display data and a timing signal should be connected.

Ta = 25 ± 2 °C

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V_{DD}	10.8	12.0	13.2	V	(1)
Current of Power Supply	(a) Black	I_{DD}		TBD		mA	(2), (3)
	(b) White			TBD			
	(c) N-Pattern			TBD			
Vsync Frequency		f_V	TBD	60	TBD	Hz	-
Hsync Frequency		f_H	TBD	67.5	TBD	kHz	-
Main Frequency		F_{dclk}	TBD	148.5	TBD	MHz	-
Rush Current		I_{RUSH}	-	-	TBD	A	(4)

Note (1) The ripple voltage should be controlled under 10% of V_{DD}.

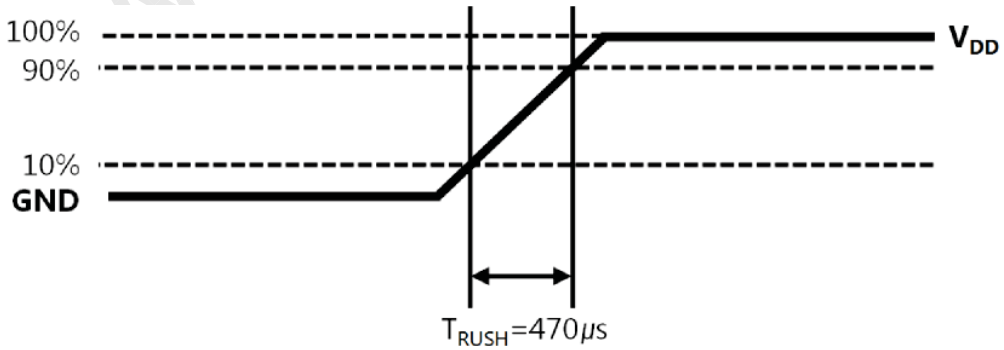
Note (2) f_V=60Hz, f_{DCLK}=148.5MHz, V_{DD}=12.0V, DC Current.

Note (3) The pattern for checking the power dissipation (LCD module only).

a) Black Pattern b) White Pattern c) N-Pattern



Note (4) Conditions for measurement



The rush current, I_{RUSH} can be measured when T_{RUSH} is 470μs.

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4.2 BACK LIGHT UNIT

Item	Min.	Typ.	Max.	Unit	Note
Operating Life Time	-	50,000	-	Hour	(1)

Note (1) It is defined as the time to take until the brightness reduces to 50% of its original value.
[Operating condition : Ta = 25±2℃]

4.3 CONDITION & SPECIFICATION OF CONVERTER'S INPUT

Items	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ.	Max.		
Input Voltage	Vin	-	22	24	26	V	Ta=25±2 °C
Inrush Current (*2)	Inrush	Vin = 24.0V dim =Max	-	-	TBD	A	Normal Mode Note (2),(3)
Output Current (*1)	ILED	Vin = 22.0~26.0V dim =Max	(124)	(130)	(136)	mAmean	After 1 hour Warm-up, @1string
Converter On/Off Control	ENA	Enable	2.4	-	5.25	V	-
		Disable	-0.3	-	0.4		
A_DIM	V_{A_DIM}	V_{IN} = 24V	0	-	3.3	V	-
	D_{A_DIM} (Duty)	V_{IN} = 24V V_{A_DIM}= 3.3V	-	TBD	-	%	
		V_{IN} = 24V V_{A_DIM}= 0V	-	TBD	-	%	

Note (1) All data was approved after running 120 minutes.
(2) Inrush is measured within BLU on 10ms after leaving the BLU as it is at least 1hr or more at room temperature(25℃)
(3) Additional Appendix for Input current at room temperature (25℃)

Items	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ	Max.		
Input Current (Normal Mode)	Iovershoot	Vin=24V, Dim=Max	-	12.1	TBD	Amean	Overshoot Current After Turn-on
	Isaturation		-	TBD	TBD	Amean	Saturation current after 1hr aging

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5. INPUT TERMINAL PIN ASSIGNMENT

5.1 INPUT SIGNAL & POWER

Connector : FI-RE51S-HF-J (JAE)

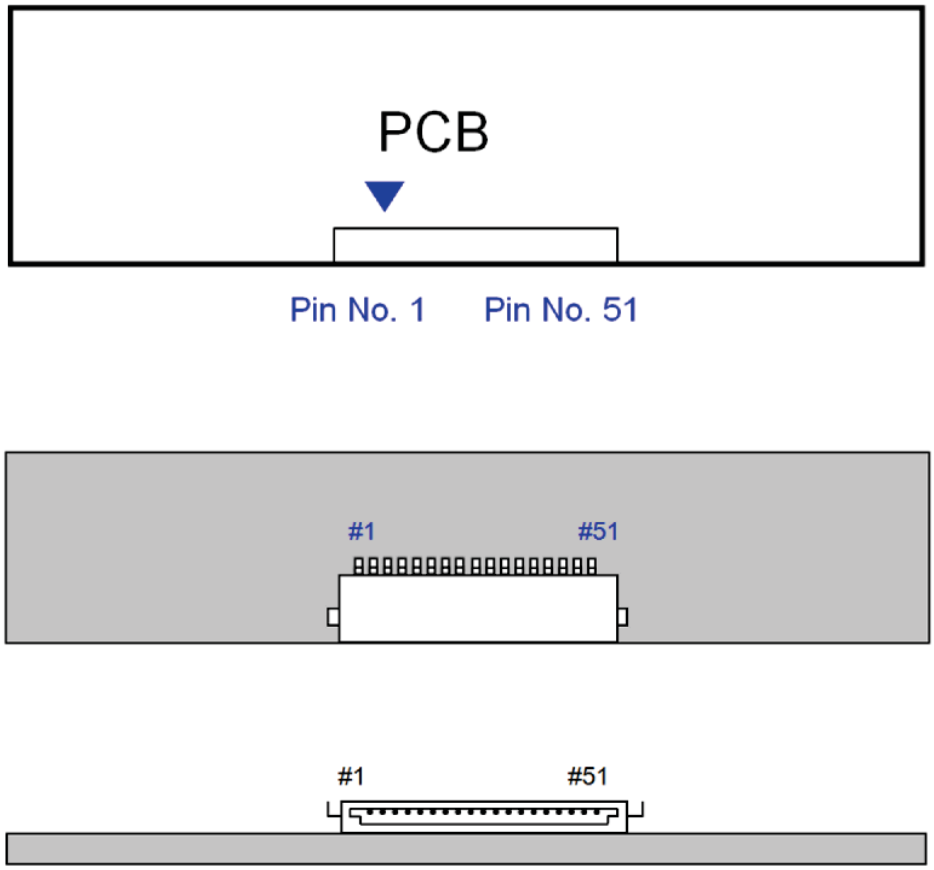
PIN No.	Description		PIN No.	Description		
1	V_{DD} (12V)		26	LVDS Signal	Rx2[A]P	
2	V_{DD} (12V)		27		Rx2[B]N	
3	V_{DD} (12V)		28		Rx2[B]P	
4	V_{DD} (12V)		29		Rx2[C]N	
5	V_{DD} (12V)		30		Rx2[C]P	
6	No Connection		31	GND		
7	GND		32	LVDS Clock	Rx2CLK_N	
8	GND		33		Rx2CLK_P	
9	GND		34	GND		
10	LVDS Signal	Rx1[A]N	35	LVDS Signal	Rx2[D]N	
11		Rx1[A]P	36		Rx2[D]P	
12		Rx1[B]N	37	No Connection		
13		Rx1[B]P	38	No Connection		
14		Rx1[C]N	39	GND		
15		Rx1[C]P	40	No Connection		Note(1)
16	GND		41	No Connection		
17	LVDS Clock	Rx1CLK_N	42	No Connection		
18		Rx1CLK_P	43	No Connection		
19	GND		44	No Connection		
20		Rx1[D]N	45	LVDS_SEL		Note(2)
21		Rx1[D]P	46	No Connection		Note(1)
22	No Connection		47	No Connection		
23	No Connection		48	No Connection		
24	GND		49	No Connection		
25	LVDS Signal	Rx2[A]N	50	No Connection		
			51	No Connection		

Note (1) No Connection : These pins are only used for SAMSUNG internal purpose.
Note (2) LVDS Option : High(3.3V) → Normal NS LVDS format
Low(GND or N.C) → JEIDA LVDS format
Sequence : On = V_{DD}(T1) ≥ LVDS Option ≥ Interface Signal(T2)
Off = Interface Signal(T3) ≥ LVDS Option ≥ V_{DD}

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Note (3) LVDS Connector



a. All GND pins should be connected together and also be connected to the LCD's metal chassis.
b. All power input pins should be connected together.
c. All N.C pins should be separated from other signal or power.

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5.2 CONFIGUARATION OF INPUT PIN OF CONVERTER

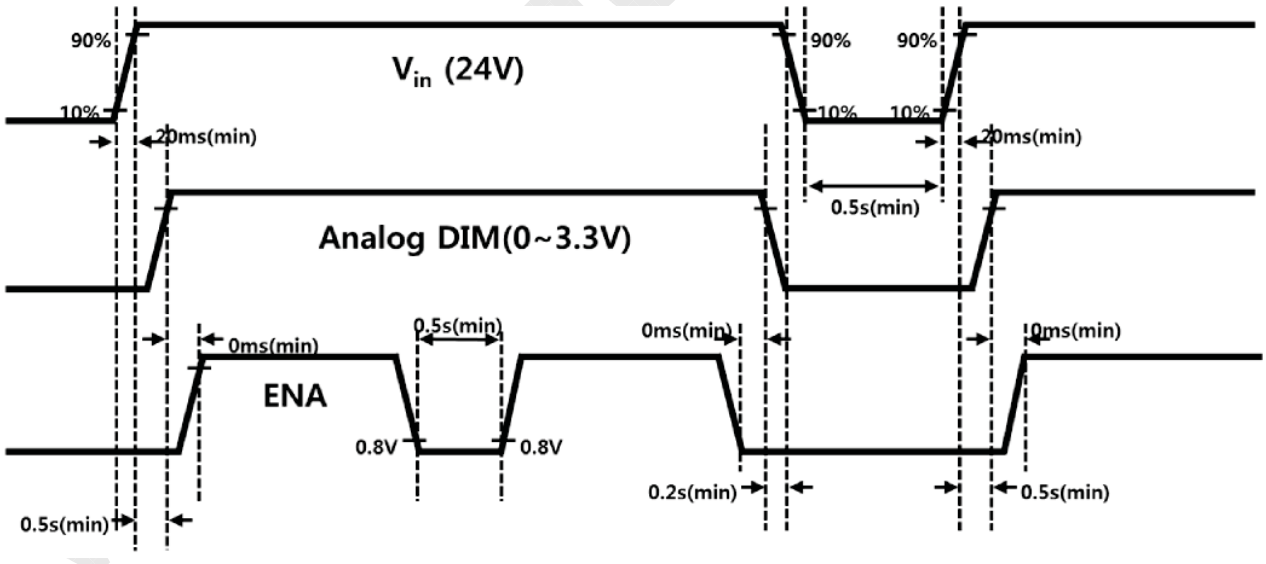
CN1 (Master) Input Connector Model No. : 22022WR-H14B2 (YEONHO)

Pin No.	SYMBOL	Pin Configuration(FUNCTION)
1, 2, 3, 4, 5	Vin	Power Supply DC 24V
6, 7, 8, 9, 10	GND	Ground
11	NC	No connection
12	ENA	Converter on/off Control signal
13	A_DIM	Analog Dimming Control Signal
14	NC	No Connection

CN2 (Slave) Input Connector Model No. : 22022WR-H14B2 (YEONHO)

Pin No.	SYMBOL	Pin Configuration(FUNCTION)
1, 2, 3, 4, 5	Vin	Power Supply DC 24V
6, 7, 8, 9, 10	GND	Ground
11,12,13,14	NC	No connection

5.3 THE POWER SEQUENCE FOR INPUTTING TO THE CONVERTER



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5.4 LVDS INTERFACE

- LVDS Receiver : Tcon(Merged)
- Data Format (JEIDA & Normal) Default LVDS Option : JEIDA

LVDS OPTION(input : pin9) : IF THIS PIN : LOW (GND or N/C) → JEIDA LVDS FORMAT
OTHERWISE : HIGH (3.3V) → NORMAL NS LVDS FORMAT

	LVDS pin	JEIDA -DATA	VESA -DATA
TxOUT/RxIN0	TxIN/RxOUT0	R2	R0
	TxIN/RxOUT1	R3	R1
	TxIN/RxOUT2	R4	R2
	TxIN/RxOUT3	R5	R3
	TxIN/RxOUT4	R6	R4
	TxIN/RxOUT6	R7	R5
	TxIN/RxOUT7	G2	G0
TxOUT/RxIN1	TxIN/RxOUT8	G3	G1
	TxIN/RxOUT9	G4	G2
	TxIN/RxOUT12	G5	G3
	TxIN/RxOUT13	G6	G4
	TxIN/RxOUT14	G7	G5
	TxIN/RxOUT15	B2	B0
	TxIN/RxOUT18	B3	B1
TxOUT/RxIN2	TxIN/RxOUT19	B4	B2
	TxIN/RxOUT20	B5	B3
	TxIN/RxOUT21	B6	B4
	TxIN/RxOUT22	B7	B5
	TxIN/RxOUT24	HSYNC	HSYNC
	TxIN/RxOUT25	VSYNC	VSYNC
	TxIN/RxOUT26	DEN	DEN
TxOUT/RxIN3	TxIN/RxOUT27	R0	R6
	TxIN/RxOUT5	R1	R7
	TxIN/RxOUT10	G0	G6
	TxIN/RxOUT11	G1	G7
	TxIN/RxOUT16	B0	B6
	TxIN/RxOUT17	B1	B7
	TxIN/RxOUT23	RESERVED	RESERVED

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5.5 INPUT SIGNALS, BASIC DISPLAY COLORS AND GRAY SCALE

COLOR	DISPLAY (8bit)	DATA SIGNAL																								GRAY SCALE LEVEL
		RED								GREEN								BLUE								
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7	
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
GRAY SCALE OF RED	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	DARK ↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			R3~ R252
	↓ LIGHT	:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			
		1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R253
		0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R254
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R255
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	DARK ↑	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G1
		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			G3~ G252
	↓ LIGHT	:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			
		0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G253
		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G254
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G255
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	DARK ↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	B1
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	B2
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			B3~ B252
	↓ LIGHT	:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	B253
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	B254
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	B255

Note) Definition of Gray

Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray(n = Gray Level)

Input Signal : 0 = Low Level Voltage, 1 = High Level Voltage

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6. INTERFACE TIMING

6.1 TIMING PARAMETERS (DE ONLY MODE)

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	Unit	NOTE
Clock	Frequency	$1/T_C$	TBD	148.5	TBD	MHz	-
Hsync		F_H	TBD	67.5	TBD	KHz	-
Vsync		F_V	TBD	60	TBD	Hz	-
Term for the vertical display	Active display period	T_{VD}	-	1080	-	Lines	-
	Total vertical	T_V	TBD	1125	TBD	Lines	-
Term for the horizontal display	Active display period	T_{HD}	-	1920	-	Clocks	-
	Total Horizontal	T_H	TBD	2200	TBD	clocks	-

Note) The signals of Hsync and Vsync must be inputted even though this T-con is operated at DE mode.

(1) Test Point: TTL controls signal and CLK at LVDS Tx at the input terminal of system.

(2) Internal VDD = 3.3V

(3) The spread spectrum

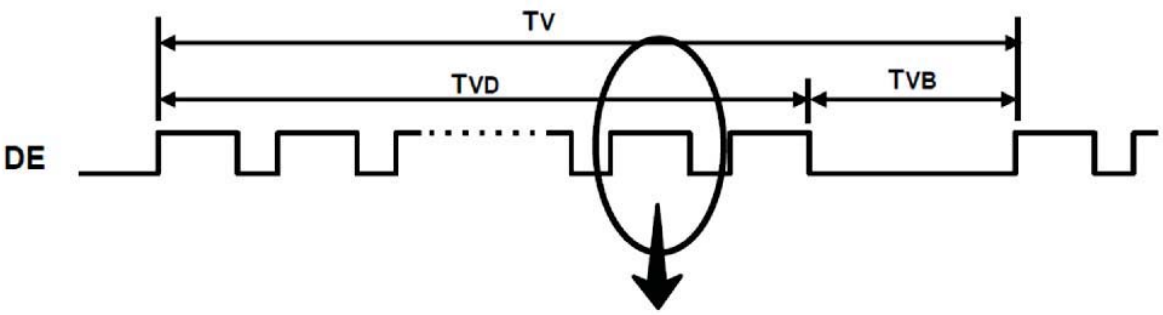
- The limit of spread spectrum's range of SET in which the LCD module is assembled should be within ± 3 %
- Frequency for modulation : 30~ 300KHz

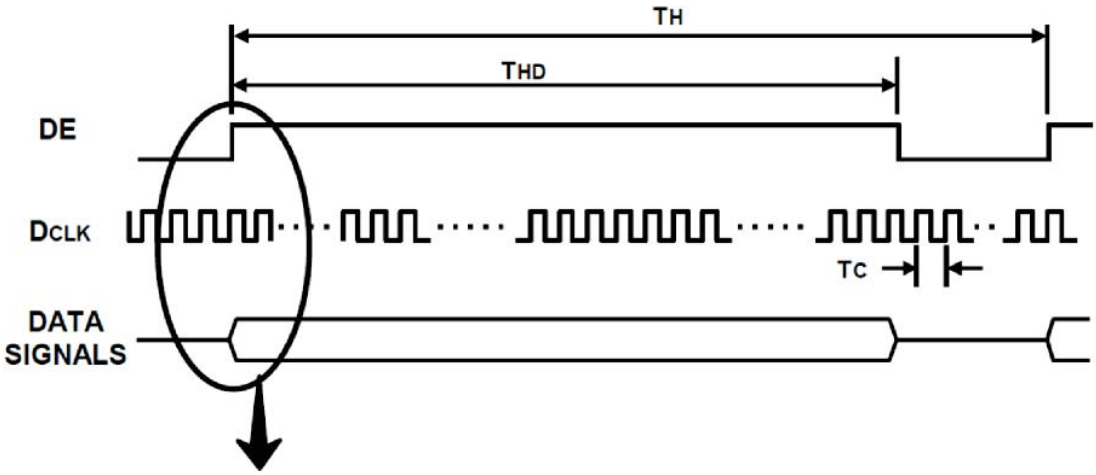
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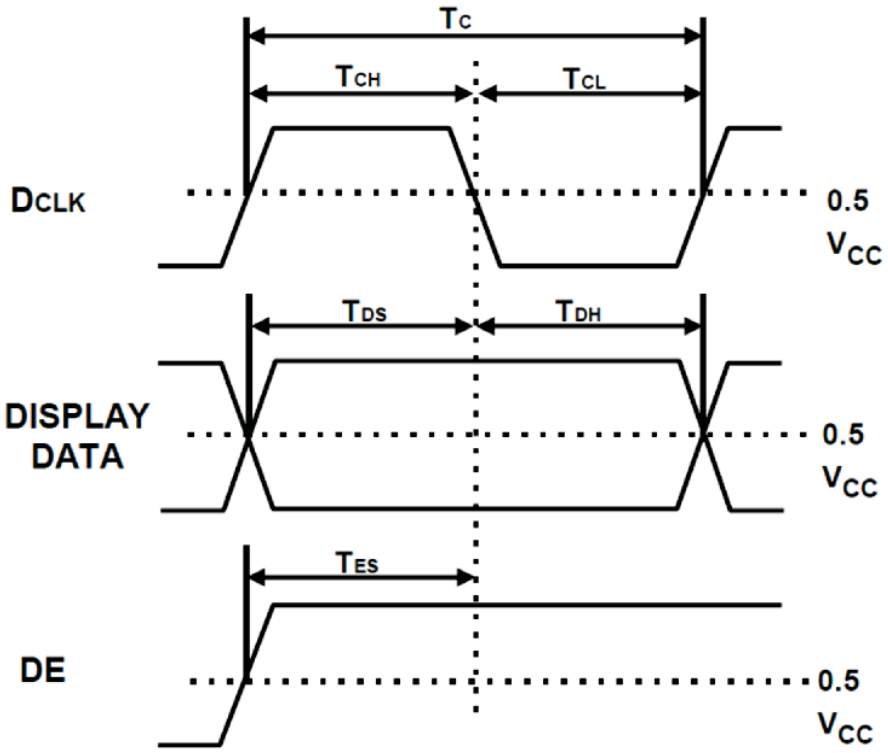
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6.2 TIMING DIAGRAMS OF INTERFACE SIGNAL (DE ONLY MODE)







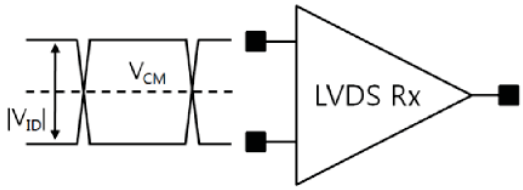
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6.3 CHARACTERISTICS OF INPUT DATA OF LVDS

(1) Specification for DC

ITEM	SYMBOL	Min.	Typ.	Max.	UNIT
Supply voltage for IO	VDD33_LVDS	3.0	3.3	3.6	V
Supply voltage in the core	VDD12_LVDS	1.1	1.2	1.3	V
Color depth			8		Bit
Input voltage at the common mode	V_{CM}	0.3		1.8	V
Input voltage for differential	$\|V_{ID}\|$	100	350	600	mV



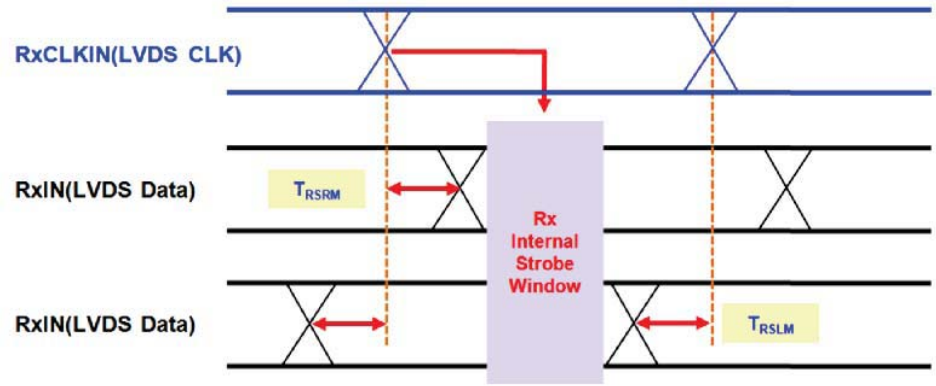
(2) Specification for AC

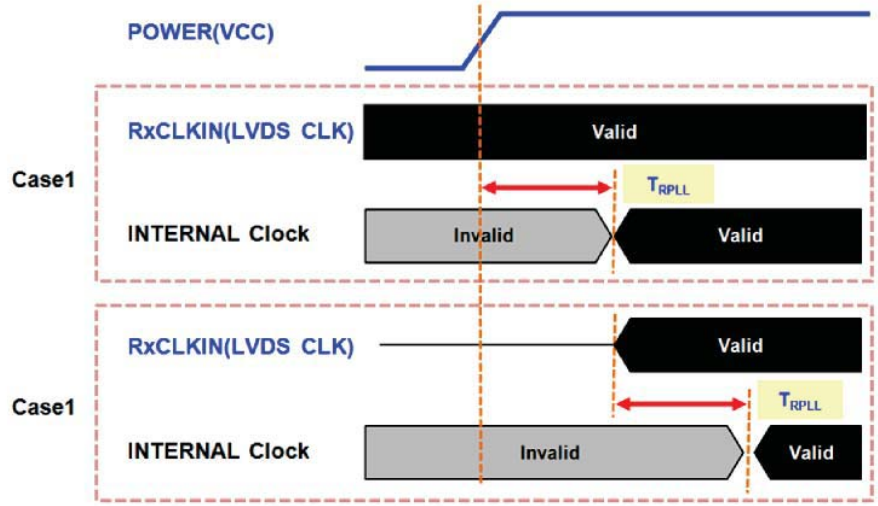
ITEM		SYMBOL	Min.	Typ.	Max.	UNIT
Frequency for input clock (=1/T)		FIN	25	-	90	MHz
Period of output clock		t_{RCP}	11.11	-	40	ns
Position of input data	FIN=85MHZ	t_{RSRM}	-	-	+400	ps
	FIN=78MHZ		-	-	+450	
	FIN=75MHZ		-	-	+500	
Position of input data	FIN=85MHZ	t_{RSLM}	-400	-	-	ps
	FIN=78MHZ		-450	-	-	
	FIN=75MHZ		-500	-	-	
Lock time		t_{RPLL}	-	-	100	usec
Duty ratio of Rx's clock for output		T_{duty}	45	50	55	%

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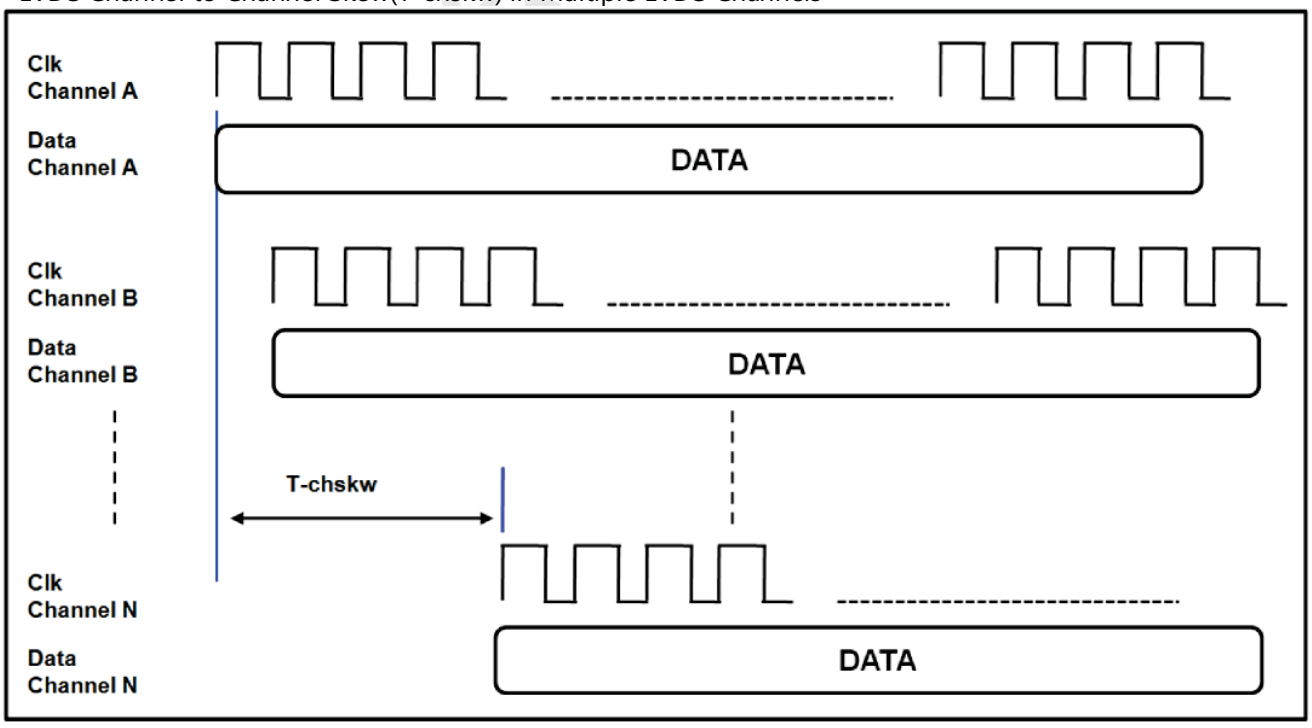
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* LVDS Channel to Channel Skew(T-chskw) in Multiple LVDS Channels



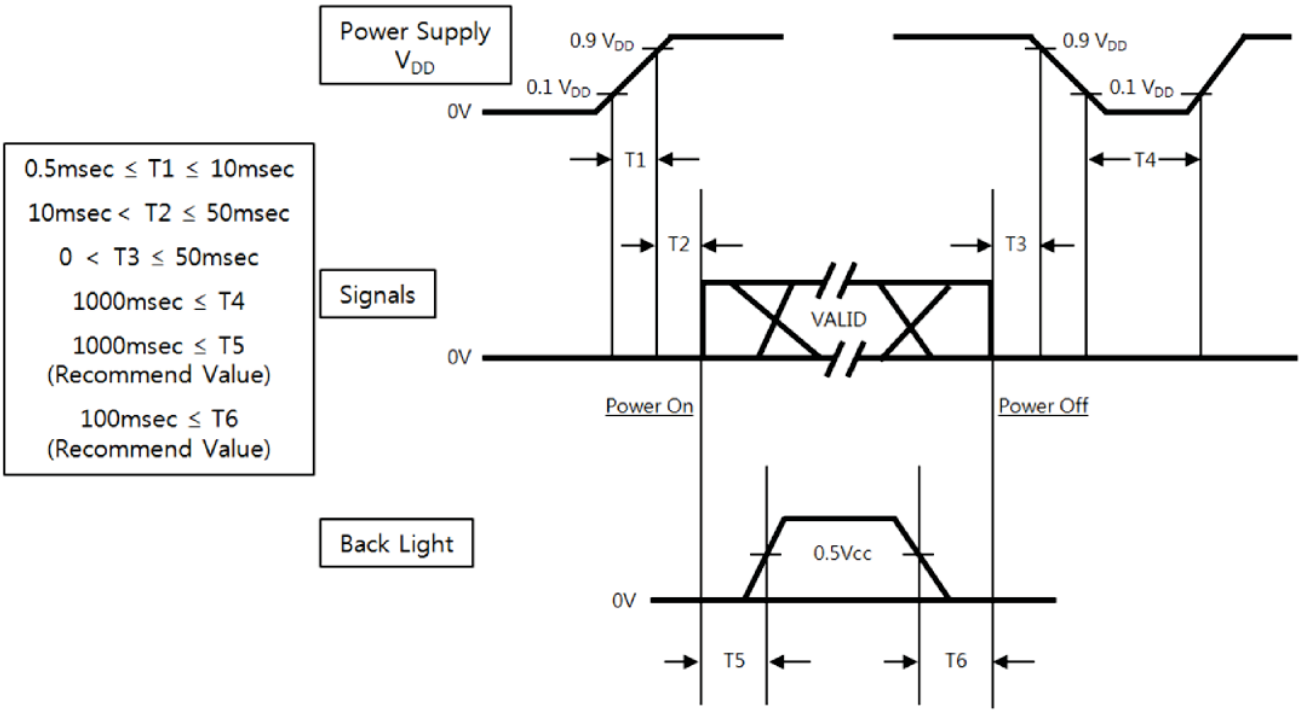
Note : DE should be synchronized with DE per each LVDS Channel and T-chskw < 16* LVDS Clock Period

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6.4 THE SEQUENCE OF POWER ON AND OFF

To prevent the product from being latched up or the DC in the LCD module from starting an operation, the order to turn the power on and off should be changed to the order as shown in the diagram below.

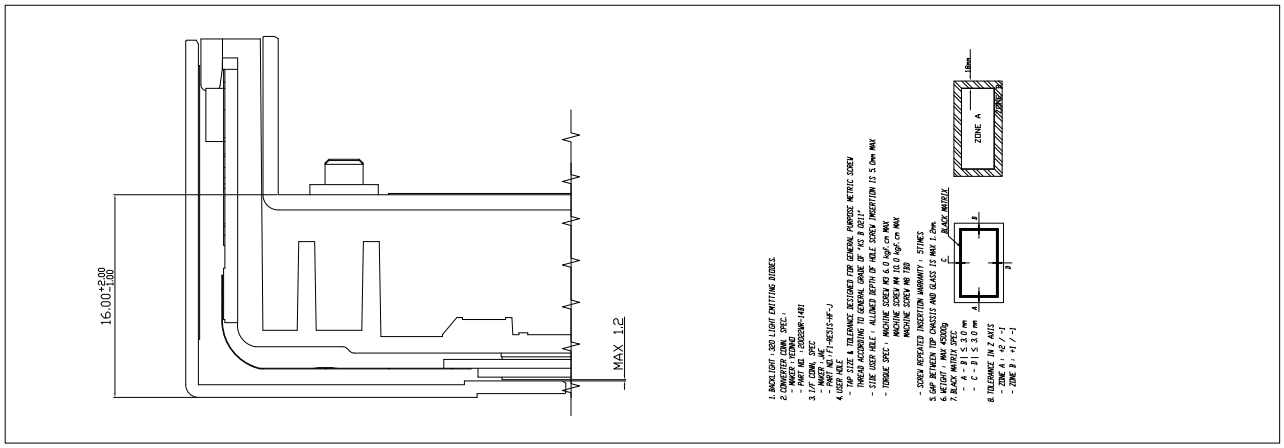


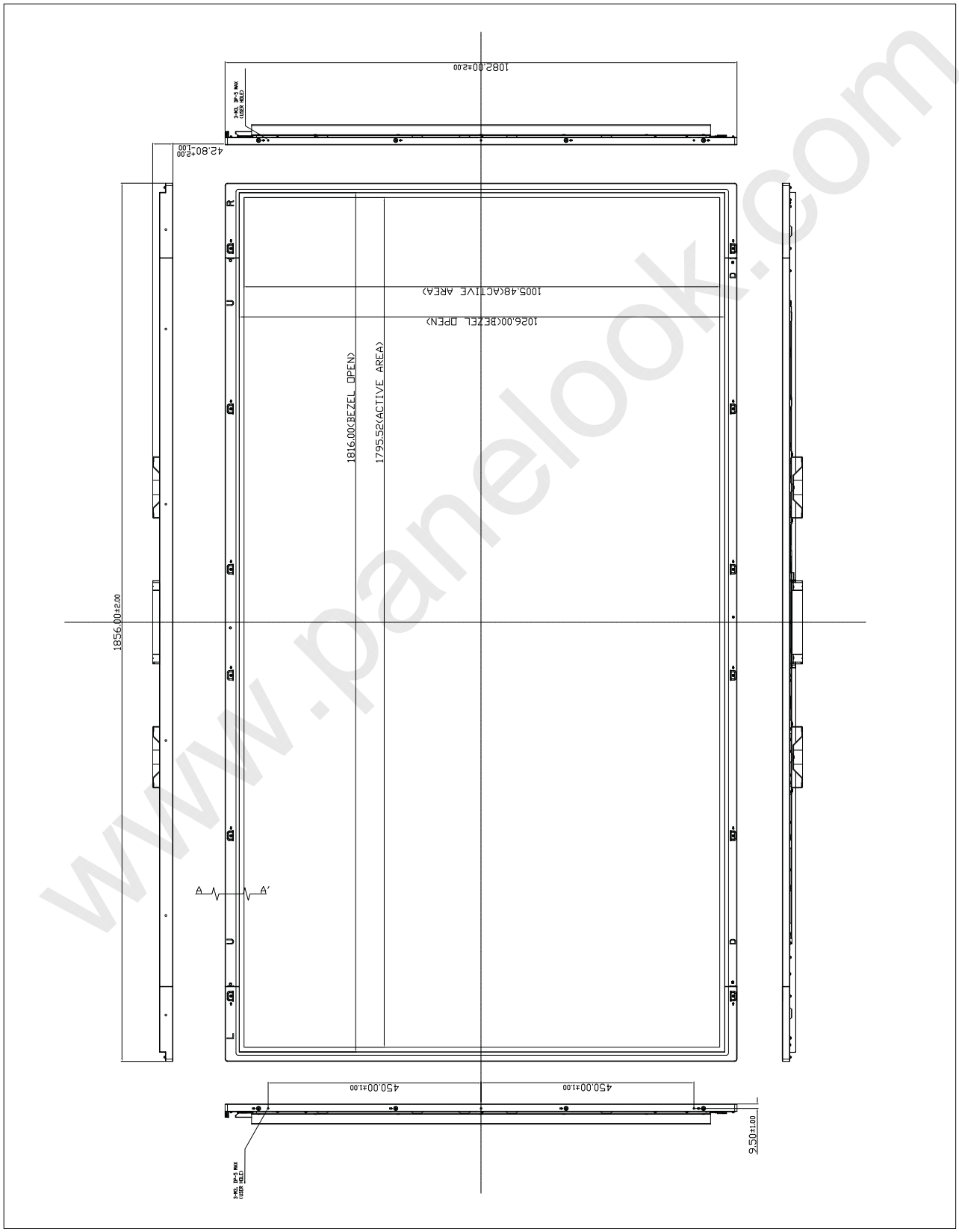
Timing	Remarks
T_1	The time, during which the level of V_{DD} is rising from 10% to 90%.
T_2	The change for time, during which the V_{DD} starts rising beyond 90% until the valid data of signal started coming in.
T_3	The change for time, during which the valid data of signal starts leaving out until the V_{DD} starts falling below 90%.
T_4	The time, during which the V_{DD} starts falling below 10% to restart the Windows.
T_5	The time, during which the signal of BLU starts rising beyond 50%.
T_6	The time, during which the signal of BLU starts falling below 50%.

- The inputted V_{DD} 's value for supply voltage, BLU, and signal to the external system of the module shall be computed with referring to the former mentioned value.
- The method to apply the voltage to the lamp within the range, which the LCD operates. When the back-light is turned on before the LCD is operated or the power of LCD is turned off before the back-light is turned off, the abnormal display on the screen may be shown momentarily.
- Please keep the level of input signal low or keep the level of impedance high when the value of V_{DD} is below 10%.
- The value shall be measured after the module has been fully discharged between the period, which the power is turned on and the period, which the power is turned off like the T4 timing. The backlight may be flashed if the interface signal remains floated when the above-mentioned signal becomes invalid.

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NO	PART NAME	CODE NO	SPECIFICATION	Q'TY	SPEC NO	REMARK
1	OUTLINE DIMENSION	-	LTI820HA01	1		

REVISION	DATE	DRA'N BY	DES'D BY	CHK'D BY	APP'D BY	DESCRIPTION OF REVISION
			J.H.LEE			
	13.02.19					

GENERAL TOLERANCE			
DISTANCE	LEVEL 1	LEVEL 2	LEVEL 3
0 < X ≤ 6	± 0.05	± 0.1	± 0.3
6 < X ≤ 30	± 0.1	± 0.2	± 0.5
30 < X ≤ 120	± 0.15	± 0.3	± 0.8
120 < X ≤ 400	± 0.2	± 0.5	± 1.2
400 < X ≤ 1000	± 0.3	± 0.8	± 2.0

REV DATE	
UNIT	mm
SCALE	
TOLERANCE	LEVEL 3
SAMSUNG DISPLAY	

CHK'D BY	
MODEL NAME	LTI820HA01
PART/SHEET NAME	OUTLINE DIM.(FRONT)
SHEET	1/2
CODE NO.	-
VER.	00

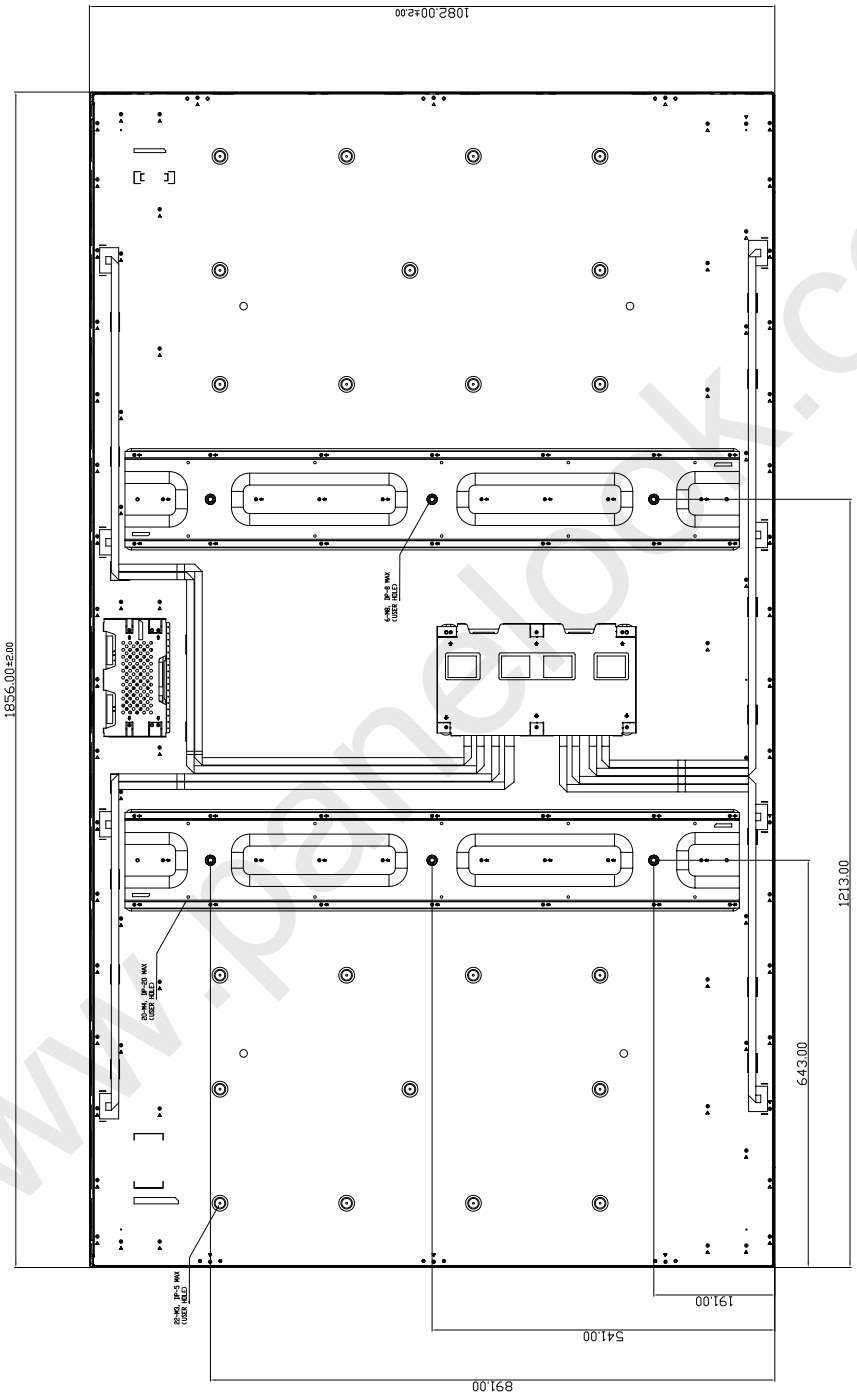
PRELIMINARY

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NO	PART NAME	CODE NO	SPECIFICATION	Q'TY	SPEC NO	REMARK
1	OUTLINE DIMENSION	-	LTI820HA01	1		



REV	DATE	DESCRIPTION OF REVISION	DRAW'N BY	DES'D BY	CHK'D BY	APP'D BY
				J.H.LEE		

UNIT	mm
SCALE	
TOLERANCE	LEVEL 3

MODEL NAME	LTI820HA01
PART/SHEET NAME	OUTLINE DIM.(BACK)
CODE NO	-

REASON	CHK'D BY

SAMSUNG DISPLAY

SPEC. NO

SHEET 2/2

VER. 00

GENERAL TOLERANCE

DISTANCE	LEVEL 1	LEVEL 2	LEVEL 3
0 < X ≤ 6	± 0.05	± 0.1	± 0.3
6 < X ≤ 30	± 0.1	± 0.2	± 0.5
30 < X ≤ 120	± 0.15	± 0.3	± 0.8
120 < X ≤ 400	± 0.2	± 0.5	± 1.2
400 < X ≤ 1000	± 0.3	± 0.8	± 2.0

PRELIMINARY

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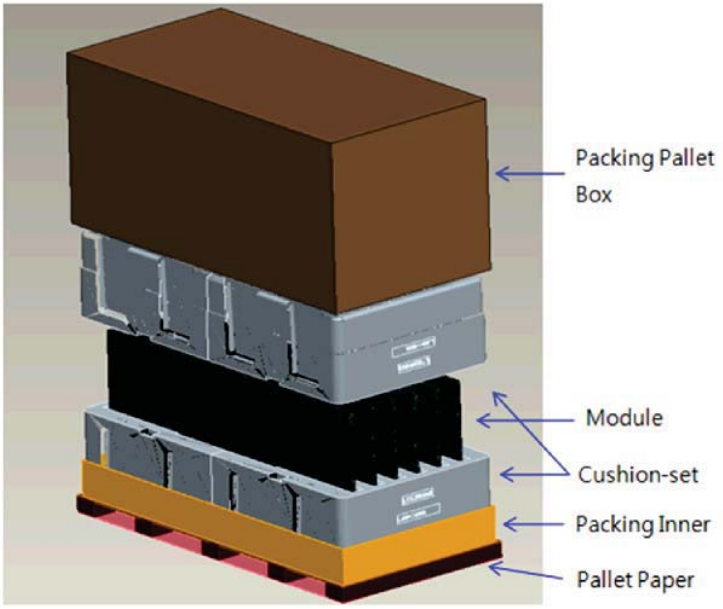
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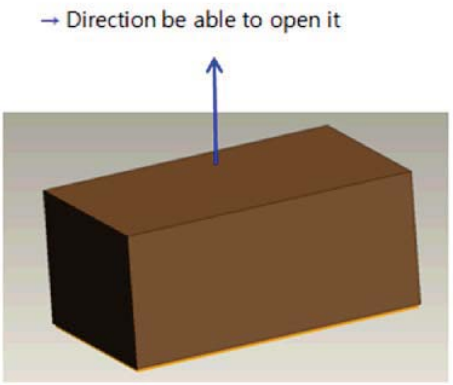
7. PACKING

7.1 CARTON (INTERNAL PACKAGE)

(1) Packing Form : EPS

(2) Packing Method





Note(1) Total Weight : Approximately 324.9kg [With Pallet Paper]
Note(2) Acceptance number of piling : 1 Pallet
Note(3) Carton size : 2014mm(H) x 1027mm(V) x 1208mm(Height) [Without Pallet Paper]
2025mm(H) x 1050mm(V) x 1345mm(Height) [With Pallet Paper]

(3) Packing Material

No	Part name	Quantity
1	Packing-Pallet BOX	1 EA
2	Bag-Shielding	6 EA
3	Protector-Panel	6 EA
4	Pallet-Paper	1 EA

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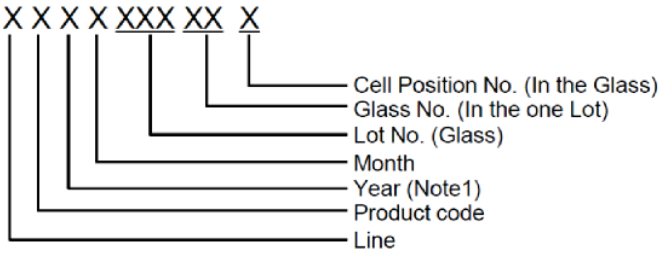
8. MARKINGS & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

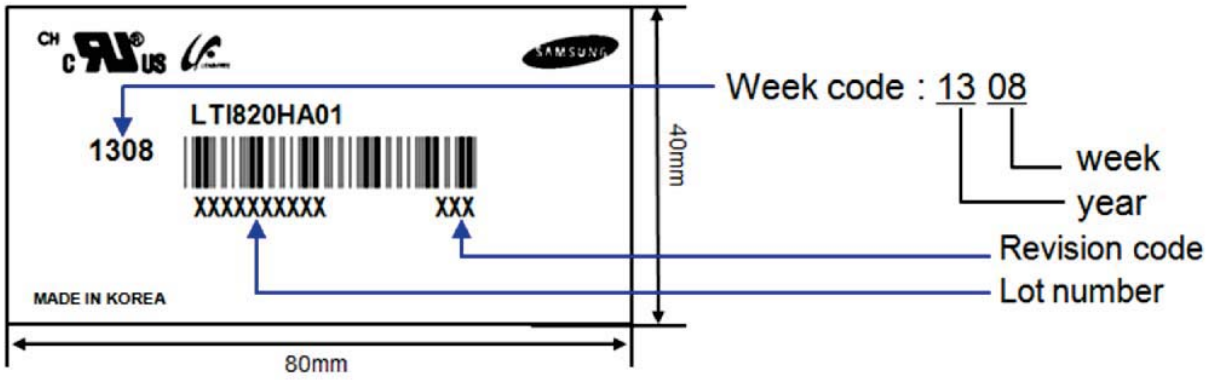
(1) Parts number : LTI820HA01

(2) Revision code : Three letters

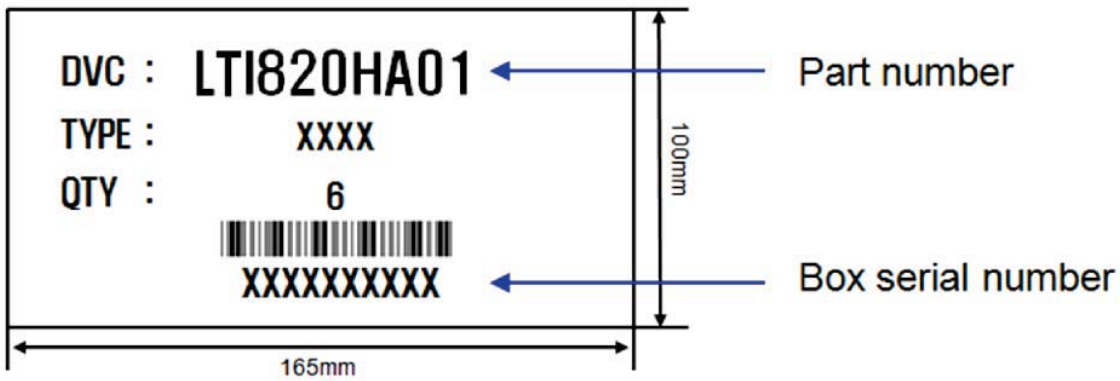
(3) Lot number :



(4) Nameplate Indication



(6) Packing small box attach



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9. GENERAL PRECAUTIONS

9.1 HANDLING

(a) When the module is assembled, It should be attached to the system firmly using every mounting holes. Be careful not to twist and bend the modules.

(b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and CCFT back-light.

(c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.

(d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.

(e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(f) The desirable cleaners are water, IPA (Isoprophyl Alcohol) or Hexane. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

(h) Protect the module from static. it may cause damage to the C-MOS Gate Array IC.

(i) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(j) Do not disassemble the module.

(k) Do not pull or fold the Lamp wire.

(l) Do not touch any component which is located on the back side.

(m) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(n) Pins of I/F connector shall not be touched directly with bare hands.

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9.2 STORAGE

We highly recommend to comply with the criteria in the table below.

ITEM	Unit	Min.	Max.
Storage Temperature	(℃)	5	40
Storage Humidity	(%rH)	35	75
Storage Life	12 months		
Storage Condition	- The storage room should be equipped with a good ventilation facility, which has a temperature controlling system. - Products should be placed on the pallet, which is away from the wall not on the floor. - Prevent products from being exposed to the direct sunlight, moisture, and water. Be cautious not to pile the products up. - Avoid storing products in the environment, which other hazardous material is placed. - If products are delivered or kept in the storage facility more than 3 months, we recommend you to leave products under the condition including a 20℃ temperature and a humidity of 50% for 24 hours. - If you store semi-manufactured products for more than 3 months, bake the products under the condition including the 50℃ temp. and the 10% humidity for 24hrs after being used.		

9.3 OPERATION

(a) Do not connect or disconnect the cable to/ from the module at the "Power On" condition.

(b) The power shall be always turned on/off by the item 6.5. "Power on/off sequence"

(c) The module has a circuit with a high frequency. The system manufacturers shall suppress the electromagnetic interference sufficiently. The methods to ground and shield are important to minimize the interference.

(d) Design the length of cable to connect between the connector for back-light and the inverter as short as possible and the shorter cable shall be connected directly.

The longer cable between that of back-light and that of inverter may cause the luminance of lamp(CCFL) to lower and need a higher startup voltage(Vs).

9.4 OPERATION CONDITION GUIDE

(a) The LCD product should be operated under normal conditions.

Normal condition is defined as below;

- Temperature : 20±15℃
- Humidity : 55±20%
- Display pattern : continually changing pattern (Not stationary)

(b) If the product will be used in extreme conditions such as high temperature, humidity, display patterns or operation time etc.., It is strongly recommended to contact SDC for Application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at Airports, Transit Stations, Banks, Stock market, and Controlling systems.

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9.5 OTHERS

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Module should be turned clockwise (regular front view perspective) when used in portrait mode.

(c) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(d) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.

(e) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen. To avoid image sticking, it is recommended to use a screen saver.

(f) This Module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

(g) Please contact SDC in advance when you display the same pattern for a long time.

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